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ABSTRACT

In order to evaluate the effectiveness of problem-solving groups, a study developed a model of group problem-solving behavior, and applied the resulting conceptual framework to 16 actual evaluations of quality circle programs (defined as a group of 3-15 persons from the same work area who meet for problem-solving). The model divides each of the successive stages of a systems model--input, process, output and feedback--into four levels or subsystems: task, individual, group, and organization, and thus defines a matrix of 16 cells into which the variables measured in evaluations of quality circle programs can be placed. Results revealed that none of the 16 published evaluations considered all four major categories of variables (the stages mentioned above), most often omitting the feedback stage. Findings suggest that: (1) problem-solving groups should be evaluated regularly to improve their effectiveness; (2) evaluations should be comprehensive, paying more attention to mechanisms that provide group members with feedback as well as to the more commonly measured input, process, and output variables; and (3) self-report data-collection procedures should be supplemented by more objective measures. (Two tables of data and one figure detailing the model are included, and 35 references are attached.) (SR)

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Evaluation of Problem-Solving Groups: The Case of Quality Circle Programs

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Abstract

This article states the case for evaluating the effectiveness of problem-solving groups, develops a model of group problem-solving behavior, and applies the resulting conceptual framework to 16 actual evaluations of quality circle programs published between 1981 and 1986. It recommends that problem-solving groups be evaluated to improve their effectiveness, and that evaluations be comprehensive -- attending to feedback variables, and to input and process variables, as well as to the commonly measured output variables, and that self-report data-collection procedures be supplemented by more objective measures.

Evaluation of Problem-Solving Groups: The Case of Quality Circle Programs

Our general purpose is to provide a conceptual framework for evaluating and improving the performance of problem-solving groups in organizations. Toward this end, a review of the small-group literature has indicated that concentration on the quality circle type of problem-solving group is most expedient, as that particular literature has been growing and now contains a number of articles solely concerned with the evaluation of quality circle programs.

A quality circle is a group of 3 to 15 people from the same work area that meets on a regular basis to identify, analyze, and solve problems of various types in that area (Thompson, 1982). Circle members receive special training in the mechanics of running a meeting and in the techniques of group problem solving; and the circle members, rather than management, choose the problems and projects they will work on. Circles receive guidance from an advisor (facilitator) who attends most circle meetings, but who is not a circle member. When the circle members have solved a problem, they prepare a recommendation and present it to management for decision and implementation.

The specific objectives of this article are to answer the following questions:

(1) Why should problem-solving groups be evaluated? Under

this heading we consider the low incidence of evaluation, and the reasons for and against evaluation.

(2) What variables can be measured to evaluate and increase the effectiveness of problem-solving groups? Here we develop a systems model of the problem-solving process to classify the variables and to suggest the potential relationships among them.

(3) What variables have been measured in published evaluations of quality circle programs? Under this heading we analyze 16 evaluation studies of quality circle programs in terms of the problem-solving model and note the comprehensiveness of each study and the variables that were measured.

The Case for Evaluating Problem-Solving Groups

The Low Incidence of Evaluation

Although the American Society for Quality Control (Quality Circles Technical Committee, 1982) has indicated that evaluation and improvement are essential steps in the development of quality circle programs, Gryna's (1981) investigation of quality circles in 11 organizations disclosed that it was unusual to find a formal program of evaluation. Most times he found an informal system in which justification for the continuation of the program rested on individual instances of personal and team development or outstanding

tangible gains, including "the positive effect that circles have in improving communication between management and workers" (p.19). Similar results were reported by Kirby and Holoviak (1985), who investigated the content and extent of quality circle program evaluation in a survey of 500 companies. On the basis of 88 responses, they concluded that 28% collected no information on their quality circle programs and only 22% attempted to measure any changes in productivity or job quality.

Reasons Against Evaluation

Sokol and Hurwitz (1983) surveyed the audience at the 1982 annual conference of the International Association of Quality Circles by asking audience members to complete the statement, "The problems of evaluating quality circles within my organization are ...". The responses fell into five categories: (1) Programs were too new for evaluation. (2) Program objectives were vague, so evaluation was difficult. (3) No support for evaluation activity due to its cost and to a lack of cooperation from middle management and unions. (4) Lack of knowledge as to how to evaluate. (5) Negative effect of evaluation on people being evaluated.

Donovan and Jury (1983) added the objection that even where quality circle staffs recognize the practical and strategic value of systematic program evaluation, their time is consumed with the work of launching and maintaining circle activities, and program evaluation ends up not being done. Similar comments

have been cited by Beardsley and Malmquist (1983), Dewar (1980), and Zahra, Wiebe, and Day (1983). Finally, it is interesting to note that Rieker and Sullivan (1981) argued that quality circle programs should not be subject to special measurement (i.e., evaluation) any more than other organizational elements, but that quality circles should be treated as a normal part of the organization important for the performance of the entire organization and should be judged in the same manner as a Personnel Department or an Accounting Department.

Seybolt and Johnson (1985) summarized the reasons given for not evaluating quality circle programs, noting the lack of management interest, the cost and complexity of evaluation, the difficulty of quantifying benefits, the inappropriateness of premature evaluation, and the possibility that evaluation will either produce a Hawthorne effect or adversely impact the participatory culture engendered by quality circles.

Reasons for Evaluation

In spite of the foregoing objections, Wood, Hull, and Azumi (1983) contend that evaluation of quality circle programs is necessary in order to avoid the adoption-disappointment-discontinuation cycle that is characteristic of managerial fads, and urge that managers should realize that the data generated by well-designed evaluations can be used to modify existing programs as well as for deciding whether or not to adopt a quality circles program. Similarly, Sokol and Hurwitz (1983)

advocate evaluation on the basis that it is a form of feedback that enables managers to make a rational appraisal of the impact of quality circles, and that it provides evidence that holds more credence than do subjective opinions. They state that there is a need to know how the program is progressing, how members of the organization are being affected, and what can be learned to improve the program.

Seaton (1984) supports evaluation by indicating the improvements that evaluation brought about in the quality circle program in his organization. Thompson (1982), noting that sooner or later every quality circle program runs out of steam, advises that it is necessary to be informed about the status of the program, so as to introduce constructive activities that will prevent its failure. This same sentiment is found in Tortorich et al. (1981), where the Martin Marietta practitioners regard evaluation as a process that provides insights as to how to improve the quality circle program. Donovan and Van Horn (1980) note that the systematic evaluation of circles was a means for winning management support which was crucial to the survival and growth of the quality circle program at Honeywell Inc. Finally, Seybolt and Johnson (1985) give similar reasons when they recommend evaluation to justify program expense, to create feedback for the circles, to identify problems with the program, and to provide information about employee participation and involvement.

The preceding arguments for the evaluation of quality circles are found repeatedly in the literature written by practitioners, consultants, and researchers (See Gibson, 1983; Zahra, Wiebe, & Day, 1983; Dewar, 1980; Beardsley & Malmquist, 1983; and Ingle, 1982). Their import is that evaluation is essential to the survival and improvement of quality circle programs. Thus, for the purpose of maintaining and enhancing the effectiveness of organizations, it is important to encourage a more general utilization of evaluation both for quality circle programs and for problem-solving groups in general. Toward this end, there appears to be a need for research into the basic components of the evaluation process. The present investigation concentrated on developing a model of the group problem-solving process, defining the variables that can be evaluated, and applying the resulting conceptual framework to 16 published evaluations of quality circle programs. We did not address the issues of how standards for those variables might be set, who should perform the evaluation, or how evaluation research should be designed. Steel and Shane (1986) recently examined the last issue and concluded that the majority of quality circle evalutions suffered from serious deficiencies in design.

A Framework for Evaluating Problem-Solving Groups

This section is concerned with noting the basic elements of a system and developing a system-oriented model applicable to problem-solving groups. The basic elements of a system may be

described in terms of inputs, processes, outputs, and feedback. Inputs are processed by the system to produce certain outputs, which are evaluated by the environment, resulting in a feedback of information that may influence subsequent inputs and processes to produce different outputs later in time. In his article on how to make quality circles work, List (1982) encourages the establishment of a communication system for receiving feedback about individual and collective circle health and vitality. There are several definitions of the term "feedback" in the literature (cf. Hanson, 1975; Nadler, 1979). The definition employed in this paper refers to the flow of information to group members about their performance and its consequences.

In Figure 1, the basic elements of the systems model are elaborated into the components of a "Group Problem-Solving Model." Here, the four system elements are presented as categories headed (1) Inputs, (2) Processes, (3) Outputs, and (4) Feedback, which refer to conditions prevailing, interaction processes, results of group activities, and information to the group about its performance. Each of the four categories in the model contains four subcategories related to: (1) the task, (2) the individual, (3) the group, and (4) the organization. Organizational and environmental factors are combined into a single category because the organization is the major part of the group's environment and because few variables outside the

organization affect the group directly. The title of each subcategory in Figure 1 reflects the basic system element of which it is a part; thus the subcategories under Process Variables are described as procedures or activities, whereas the corresponding subcategories under Output Variables are characterized as results or changes.

Insert Figure 1 about here

Analysis of Quality Circle Evaluations

The model presented above was used to analyze 16 evaluation studies of quality circle programs, which were reported between 1981 and 1986. One aim of this analysis was to determine how frequently each category and subcategory of the model was addressed by the evaluators. The results are summarized in Table 1. The totals across the bottom of this exhibit show that in the category of Input Variables, 7 of the 16 studies or 44% examined at least one subcategory, with attention being given most often to organizational aids and constraints, then to individual characteristics, and less frequently to task nature and group characteristics. In the category of Process Variables, where 8 studies (50%) examined at least one subcategory, the most attention was given to group interaction; less attention was paid to task problem-solving procedures, individual activity, and organizational influences.

Insert Table 1 about here

The most evaluated category was that of Output Variables. All 16 studies investigated at least one subcategory of Output Variables: 15 assessed changes in individual characteristics; 13, changes in task results; 10, changes in group relations; and 9 assessed changes in organizational aids and constraints.

The least attention was paid to Feedback Variables. Only two studies addressed this area: The first study, Seelye, Stewart, and Sween (1982), investigated the flow of information concerning economic savings (task feedback), member attitudes (individual feedback), and circle problem-solving skills (group feedback). The second study, Mento et al. (1984) commented on the absence of task, individual, and group feedback in the program that they investigated. Two other authors (Seaton, 1984; Wirtz, 1984) noted that as a result of their evaluations program changes were made to improve feedback mechanisms, but they did not actually measure feedback. Three studies (Jenkins & Shimada, 1983; Seybolt and Johnson, 1984, 1985) evaluated feedback about job performance, but not feedback about the quality circle program itself. None of the studies evaluated the subcategory of feedback from the organization (e.g., recognition, rewards), although this is acknowledged to be an important component of quality circle programs.

Comprehensiveness of Individual Evaluation Studies

The data in Table 1 show that none of the evaluations examined all four major categories of the model: seven studies evaluated output only; the other nine evaluated input, process, or feedback variables in addition to output. Thus it appears that the evaluations were of two types: those that evaluated only output variables and those that evaluated input, process, or feedback variables as well as output variables. The former type was concerned with establishing whether the quality circle program was beneficial to the organization (e.g., Hunt, 1981; Steel, Mento, & Rehg, 1985). The latter type of study was done in organizations where the circle program had been accepted by management, and the aim of the evaluation was to gather information that could be used to improve the program, as well as to assess its effectiveness (e.g., Stinnett & Perrill, 1982; Hodgetts & Fountain, 1983; Zahra, Wiebe, & Day, 1983).

Measured Variables

Another reason for analyzing evaluations of quality circle programs was to operationalize the model by identifying measured variables within each of its subcategories. These variables were generally measured by items on survey questionnaires. As summarized in Table 2 they help to define the components of the model. The Table "Measured Variables ofthe Group Problem-Solving Model," provides details as to what has been measured in each of the categories and subcategories

of the model. For example, in the category of Input Variables, the subcategory of Task Nature was measured in terms of task interest, task skills requirements, task variety, and task authority needs. When various authors used slightly different labels for nearly identical variables, we chose a single term to describe the measured variable in order to avoid redundancy.

Insert Table 2 about here

In the category of Output Variables, most of the measures of Task Results are objective, e.g., performance rates, unit costs, reject rates, and number of presentations to management. Some of the Changes in Individual Characteristics are also objectively measurable, but most other variables in the model were measured by means of subjective rating scales on questionnaires completed by members of the quality circle programs. Here we agree with Goodman (1986) and others who urge that questionnaire data be supplemented by direct observation and by archival information, to add objectivity and accuracy to the data employed for evaluation.

The last category, Feedback Variables, contains only the few variables that were actually measured in the studies reviewed. These variables involved feedback to the circle members about task, individual, and group performance. Other task, individual, and group feedback activities that might have been

evaluated, but were not, include formal provision for minutes of meetings, facilitator reports, surveys of circle members as to quality of circle leadership, statistical information about meeting time and membership, special circle-leader meetings for the exchange of information, and responsiveness of the Coordinator and the Steering Committee to suggestions. None of the studies reported measures of feedback about organizational reactions to circle outputs, although they could potentially have included measures of such activities as management's responsiveness to requests for resources and measures of recognition by management of the value of circle suggestions, such as awards for outstanding circles, dinners, publicity, and monetary or other rewards.

Summary and Implications

The main findings of this paper may be summarized with reference to the three questions that guided our research:

(1) Why should problem-solving groups be evaluated?

The weight of expert opinion is that evaluation is essential to the survival and improvement of quality circle programs. Evaluation generates information that can be used by group members and by management to justify the program, and to maintain and enhance the performance of problem-solving groups.

(2) What variables can be measured to evaluate and increase the effectiveness of problem-solving groups?

The model of the group problem-solving process that was presented in this paper divided each of the successive stages of a systems model -- input, process, output and feedback -- into four levels or subsystems: task, individual, group, and organization. The model thus defined a matrix of sixteen cells into which the variables measured in evaluations of quality circle program could be placed. Each cell represented a different subcategory of variables, e.g., under the category of Input Variables appeared the subcategories of Task Nature, Individual Characteristics, Group Characteristics, and Organizational Aids and Constraints.

(3) What variables have been measured in published evaluations of quality circle programs?

It was found that most of the variables in the model were measured in 16 published evaluations of quality circle programs, taken as a group. With respect to the major categories of variables, all the studies evaluated Output Variables, about half the studies evaluated Input and Process Variables, and only two studies evaluated Feedback. The individual evaluations were generally not comprehensive. None of them evaluated all four major categories of variables, although half of the studies looked at three of the categories -- usually Input,

Process, and Output Variables. Several measured variables were found for each subcategory of the model, with the notable exception of Organizational Feedback. Most variables were measured by means of self-report questionnaires.

Practical Implications

The following recommendations are based on the foregoing analysis of published evaluations of quality circle programs:

(1) The performance of problem-solving groups should be evaluated regularly.

(2) Evaluators should employ the group problem-solving model to design more adequate evaluations of quality circles and other problem-solving groups.

(3) More attention should be paid to mechanisms that provide group members with feedback (task, individual, group, and organizational) relevant to their problem-solving activities.

(4) Questionnaire data should be supplemented by direct observation, archival information, and other objective data.

Research Implications

Further research would increase the generalizability and utility of the present model. Whereas the present study concentrated on quality circles, further investigation would determine whether the model applies equally well as a framework

for evaluating the performance of problem-solving groups in general. The utility of the model would be increased by identifying existing instruments that are available to measure the variables in the model, and by determining what the small-group literature says about the impact of particular input, process, and feedback variables on output variables of interest to the organization.

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Table 1

Analysis of Sixteen Evaluations of Quality Circle Programs

			System Component Evaluated			
Case No.	Author and Year		Inputs	Processes	Outputs	Feedback
1	Hunt	1981			T I G O	
2	Harper & Jordan	1982		O	T I G O	
3	Seelye, Stewart, & Sween	1982	T I G O		T I	T I G
4	Stinnett & Perrill	1982	I O	I G	T I	
5	Hodgetts & Fountain	1983	O	T	T I	
6	Dean	1983	I	T	I	
7	Jenkins & Shimada	1983			T I	
8	Zahra, Wiebe, & Day	1983	I G O	G	T I G O	
9	Seybolt & Johnson	1984			T I G O	
10	Mento, Steel, Shane, & Lloyd	1984		G	T I G	T I G
11	Seaton	1984	O	G O	T I O	
12	Wirtz	1984	T	I G	G	
13	Seybolt & Johnson	1985			T I G O	
14	Steel, Mento, & Rehg	1985			T I G O	
15	Elvins	1985			I G O	
16	Marks	1986			T I G O	
Subcategory Totals			2 4 2 5	2 2 5 2	13 15 10 9	2 2 2 0
Category Totals			7	8	16	2
Percent of All Cases			44	50	100	13

Code: T = Task
I = Individual
G = Group
O = Organization

Table 2

Measured Variables of the Group Problem-Solving Model

Categories and Subcategories	Measured Variables
Input	
Task Nature	Task interest, task skills requirements, task variety, task authority needs
Individual Characteristics	Personality, interests, competencies, fears, feelings, attitudes, perception of QC program, training effects
Group Characteristics	Superior-subordinate relations, role and status relations, liking and disliking among members
Organizational Aids and Constraints	Company policies, previous history of management support, availability of training facilities, reward systems, steering committee activities, facilities for QC meetings
Process	
Task Problem-Solving Procedures	Problem-selection process, problem-solving procedures and techniques, decision-making methods
Individual Activity	Participation effort expended, knowledge and skills used, verbalization, training needs evidenced
Group Interaction	Group cohesion, leadership skills, interpersonal relations, evidence of groupthink, facilitator involvement, conflicts
Organizational Influences	Interaction between QC members and other members of the organization

Table 2 (Continued)

Measured Variables of the Group Problem-Solving Model

Categories and Subcategories	Measured Variables
Output	
Task Results	Performance rates, unit costs, presentations to management, reject rates, errors, customer evaluations
Changes in Individual Characteristics	Absenteeism, lateness, turnover, work stoppages, satisfaction, grievances, attitude toward QC program, accidents, suggestions, involvement, skill development, emergence of leaders
Changes in Group Relations	Leader-subordinate relations, peer relations communication effectiveness, coordination, conflict, teamwork, cohesiveness
Changes in Organizational Aids and Constraints	Management support at all levels, working conditions, QC popularity in department, interdepartmental relations, organizational climate, company policies, customer and vendor relations, community acceptance
Feedback	
Task Feedback	Information about economic savings and other results of QC activities
Individual Feedback	Information about attitudes and activities of circle members
Group Feedback	Information about group problem-solving skills and activities
Organizational Feedback	Information about organizational consequences of the group's activities (not addressed in studies reviewed)

Figure 1: Group problem-solving model.